

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/JP2004/016380

International filing date (day/month/year)
28.10.2004

Priority date (day/month/year)
12.11.2003

International Patent Classification (IPC) or both national classification and IPC
INV. H01M4/86 H01M8/02

Applicant
NISSAN MOTOR CO., LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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Date of completion of
this opinion

see form
PCT/ISA/210

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has, within the applicable time limit:
- ☒ paid additional fees
 - ☐ paid additional fees under protest and, where applicable, the protest fee
 - ☐ paid additional fees under protest but the applicable protest fee was not paid
 - ☐ not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
 - ☒ not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☒ all parts.
 - ☐ the parts relating to claims Nos.

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-13
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations

see separate sheet

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Box No. VI Certain documents cited

1. Certain published documents (Rules 43*bis*.1 and 70.10)
and / or
2. Non-written disclosures (Rules 43*bis*.1 and 70.9)
see form 210

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item IV.

1. The separate inventions are:

I. claims 1-5, 7 directed to:

An electrolyte membrane structure which comprises an electrolyte membrane placed between an anode and a cathode. A catalyst layer is formed on both side of the electrolyte membrane by closing up conductive particles carrying catalysts between the electrodes and the electrolyte membrane. Moreover, on both side of the electrolyte membrane, a boundary layer is formed between a portion to be easily contacted with an oxygen gas and the catalyst layer. The boundary layer is formed by closing up conductive particles carrying the catalysts in an amount lower than in the catalyst layer.

II. claims 6, 8-13 directed to:

An electrolyte membrane structure which comprises an electrolyte membrane placed between an anode and a cathode. A catalyst layer is formed on both side of the electrolyte membrane by closing up conductive particles carrying catalysts between the electrodes and the electrolyte membrane. Moreover, on both side of the electrolyte membrane, a boundary layer is formed between a portion to be easily contacted with an oxygen gas and the catalyst layer. The boundary layer is formed by closing up conductive particles to which a hydrophilic treatment is carried out.

2. Specification according to rule 40.1 PCT of the reasons for which the international application is not considered as complying with the requirement of unity of invention according to Art. 3(4)(iii) PCT and Rule 13 PCT.

According to the PCT International Search and Examination Guidelines, Part III, 10.06, unity of invention has to be considered in the first place only in relation to the independent claims.

There are 4 independent claims: 1, 7, 8 & 13.

It appears that within these independent claims unity does not exist for the following reasons:

A) The "same" or "corresponding" technical feature between independent claims 1 (7) & 8 (13) is an electrolyte membrane structure wherein the catalyst layer on the anode side comprises a specific boundary layer.

This feature is already known from:

D1 : PATENT ABSTRACTS OF JAPAN vol. 1995, no. 11, 26 December 1995 (1995-12-26) -&; JP 07 201346 A (TOYOTA MOTOR CORP), 4 August 1995 (1995-08-04) cited in the application (see paragraphs [0036] - [0038], [0042] and [0043] & figure 6)

Therefore, this feature is not a special (new and inventive) technical feature.

Moreover, the special technical feature related to the first group of inventions is to be regarded as a boundary layer of a catalyst layer with a lower catalysts amount. The special technical feature related to the second group of inventions is to be regarded as a hydrophilic boundary layer of a catalyst layer.

Thus, no "same" or "corresponding" special technical features could be found between all the independent claims, as required by Rule 13.2 PCT.

B) Also the common problem underlying the inventions, i.e. the problem to provide an uniform temperature distribution in the electrolyte membrane and to limit the passage of unreacted hydrogen through the boundary layer, is already well known (see for example, from D1, the above cited passages and paragraph [0012]).

So, no common problem could be found which could serve as the general inventive concept required by Rule 13.1 PCT.

Consequently, the claims are not unitary according to rule 13 PCT.

C) Thus, the application is split into 2 groups of inventions mentioned above.

Re Item V.

1. Reference is made to the following documents:

- D1 : PATENT ABSTRACTS OF JAPAN vol. 1995, no. 11, 26 December 1995 (1995-12-26) -&; JP 07 201346 A (TOYOTA MOTOR CORP), 4 August 1995 (1995-08-04) cited in the application (computer generated translation)
D2 : US 2002/192533 A1 (GEBHARDT ULRICH ET AL) 19 December 2002 (2002-12-19)
D3 : PATENT ABSTRACTS OF JAPAN vol. 014, no. 515 (E-1000), 13 November 1990 (1990-11-13) &; JP 02 215051 A (TOSHIBA CORP), 28 August 1990 (1990-08-28)
D4: EP-A-0 273 427 (INTERNATIONAL FUEL CELLS CORPORATION) 6 July 1988 (1988-07-06)

If the applicant is that opinion that the computer generated translation is not a correct representation of the actual JP document, then the applicant is kindly requested to provide the examining division with a correct translation.

2. FIRST INVENTION

2.1 Inventive step

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of the claims 1-5 & 7 does not involve an inventive step in the sense of Article 33(3) PCT.

2.1.1 Claims 1 & 7

The document D1 is regarded as being the closest prior art to the subject-matter of the independent claims 1 & 7, and discloses (paragraphs [0036] - [0038], [0042] and [0043] & figure 6):

A fuel cell including an electrolyte membrane structure which comprises an electrolyte membrane placed between an anode and a cathode. A catalyst layer is formed on both side of the electrolyte membrane by closing up conductive particles carrying catalysts between the electrodes and the electrolyte membrane. Moreover, on both side of the electrolyte membrane, a boundary layer is formed between a portion to be easily contacted with an oxygen gas and the catalyst layer, in the periphery of said catalyst layer. The

boundary layer is formed by closing up conductive particles carrying the catalysts and conductive particles which do not carry any catalyst.

The subject-matter of claims 1 & 7 therefore differs from this known D1 in that:
In the boundary layer of the present application, the catalyst is carried in an homogenous way.

The technical effect of this difference is that the locally temperature increase between the catalyst layer and the boundary layer is minimized.
The problem to be solved by the present invention may therefore be regarded as to provide an alternative catalyst distribution in the boundary layer.

Document D2 discloses a membrane electrode assembly for a fuel cell wherein the distribution of the catalysts in the electrocatalyst layer is matched to the requirements of the particular region of the membrane. In particular, a specific distribution of the catalyst layer can be used for optimized thermal management of the fuel cell (paragraphs [0014], [0040]-[0043] and [0046] & figure 2).

From the disclosure of D2, the skilled person would therefore regard it as a normal option to use a homogeneous boundary layer in order to solve the problem posed and thus arrive to the subject-matter of claims 1 & 7.

As a consequence, the independent claims 1 & 7 are not allowable under Article 33(3) PCT for lack of inventive step.

2.1.2 Claims 4 & 5

The dependent claims 4 & 5 refer to "air gap rate" between, and "particle diameter" of the conductive particles which are smaller than in the catalyst layer.

Document D3 discloses a membrane electrode assembly wherein a boundary layer adjacent to the catalyst layer has a density higher than said catalyst layer (see abstract).

This feature is described in document D3 as providing the same advantages as in the present application, i.e. as preventing gases from flowing out. Furthermore, the skilled person in the art would seriously contemplate to deal with the porosity ("air gap rate") and with the particles diameter of the boundary layer in order to obtain a higher density.

As a consequence, the dependent claims 4 & 5 are not allowable under Article 33(3) PCT for lack of inventive step.

2.1.3 Claims 2 & 3

Dependent claims 2 & 3 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step.

3. SECOND INVENTION

3.1 Inventive step

3.1.1 Claims 8 & 13

Document D1 is also regarded as being the closest prior art to the subject-matter of claims 8 & 13.

The subject-matter of claims 8 & 13 therefore differs from this known D1 in that: a hydrophilic treatment is applied to the boundary layer of the present application.

The technical effect of this difference is that liquid is held inside the boundary layer. The problem to be solved by the present invention may therefore be regarded as to prevent gases from passing through the boundary layer.

D1 also mentions that the conductive particles of the boundary layer can be combined with other particles as silicon carbide to restrict more efficiently the temperature increase (paragraph [0052]). Document D4 refers to small silicon carbide particles used in a hydrophilic boundary layer of a fuel cell electrodes in order to act as a gas barrier by decreasing the porosity of the region and by holding liquid (column 5, lines 18-27; column 7, lines 47-58; column 8, lines 1-28 and figure 1).

The skilled person in the art would therefore regard it as a normal option to apply a hydrophilic treatment to the boundary layer in order to solve the problem posed and thus arrive to the subject-matter of claims 8 & 13.

As a consequence, the independent claims 8 & 13 are not allowable under Article 33(3)

PCT for lack of inventive step.

3.1.2 Claims 6 & 9-12

Dependent claims 6 & 9-12 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step.

Re Item VII.

1. Independent claims 1, 7, 8 and 13 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
2. In claims 3 & 10, the reference sign "9" which is to be construed as aids to an easier understanding of the defined subject-matter without limiting the scope of the claim, does not appear in any drawing (see PCT Gazette IV-5.11).
3. Claim 7 comprises all the features of the independent claim 1 and is therefore not appropriately formulated as a claim dependent on the latter (Rule 6.4 PCT). The same statement stands for claims 8 & 13.

Re Item VIII.

The application does not meet the requirements of Article 6 PCT, because the claims are not clear.

1. In the claims, the usual wording "electrolyte membrane (assembly)" should be used instead of "electrolytic membrane (structure)".
2. In claims 4 & 11, the unusual wording "air gap rate" which has been construed as "porosity" is vague and unclear, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.
3. In claims 1, 7, 8 & 13, the unusual wording "closing up" leads also to doubt on the

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subject-matter of said claims.